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IS 1448-57 (1964): Consistency of Greases at Various Temperatures [PCD 1: Methods of Measurement and Test for Petroleum, Petroleum Products and Lubricants]

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CONSISTENCY OF GREASES AT VARIOUS TEMPERATURES

(P : 57)

Adapted from UK Ministry of Supply Specification CS 2386.1

[The method given in P : 57 supersedes that in L : 19 of IS : 310 (Part II)-1954*]

1. SCOPE

1.1 This method is meant for the determination of consistency in a wide range and is, therefore, suitable for both thin and thick greases at temperatures widely different from the ambient.

NOTE 1 — Two types of plungers and three different dropping heights are provided for in this method (*see* **4.1.1**). The internal correlation between these differing test conditions as well as overall correlation between this method and the test method for the determination of cone penetration (*see* P : 60†) are not yet known. Results are, therefore, comparable when experiments are done under identical conditions only.

2. OUTLINE OF THE METHOD

2.1 The consistency is evaluated by dropping either an aluminium or silver steel plunger rod from a prescribed height on a grease sample under specified temperature conditions and determining the extent of penetration of the rod below the surface of the grease sample.

3. APPARATUS

3.1 The apparatus shall consist of the following parts assembled as shown in Fig. 1.

3.1.1 *Steel Tube* (*Fig.* 2) — of wall thickness 0·900 mm, internal diameter 20 mm and length 65 mm. The lower end of the tube is capable of being closed by means of a screw cap and the upper end is provided with a metal collar. This steel tube is used as the sample container.

3.1.2 *Metal Collar* (*Fig.* 2) — slide fits on the top of the steel tube and rests on a rim which serves as a stop preventing it from sliding down. A socket is rigidly attached to the collar with the help of three legs. The glass guide tube (**3.1.3**) sits in this socket which helps in holding the tube vertically at the required distance from the grease-surface.

3.1.3 *Glass Guide Tube* (*Fig.* 3) — of 810 mm length and 11 mm in internal diameter. This is held vertically and coaxially above the steel tube and serves as the guide tube for the plunger rod (**3.1.5**).

NOTE 2 — The wall thickness and overall diameter of the glass tube should be such that (a) it rests in the socket without excessive play, and (b) the edge of the seating at the bottom of the socket does not protrude inside the glass guide tube.

3.1.4 *Graduated Glass Tube* (*Fig.* 4) — of suitable internal diameter and 230 mm long, graduated in millimetres and fitted with a fibre cap.

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*Methods of sampling and test for lubricants, Part II.

†Under preparation.

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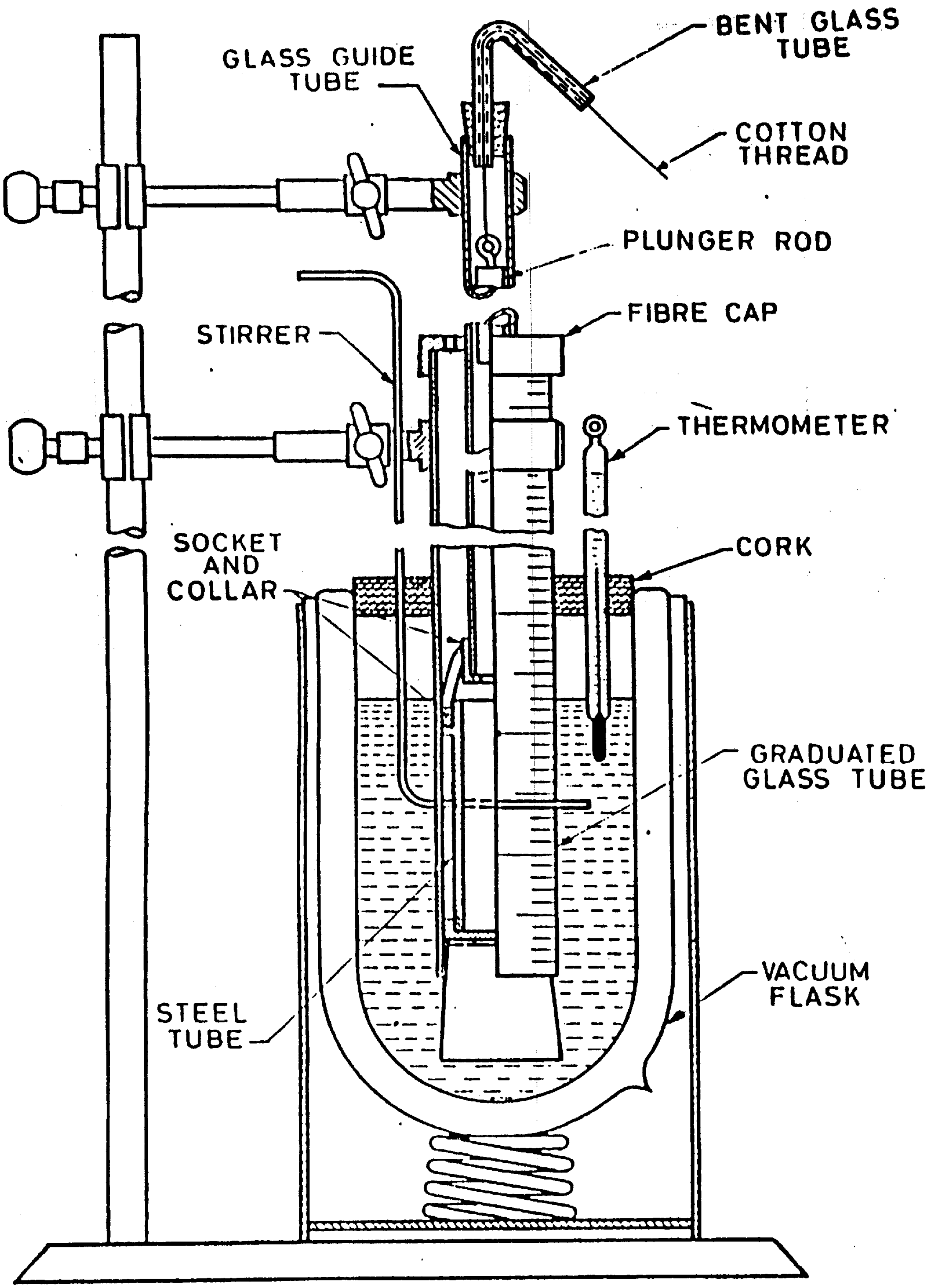
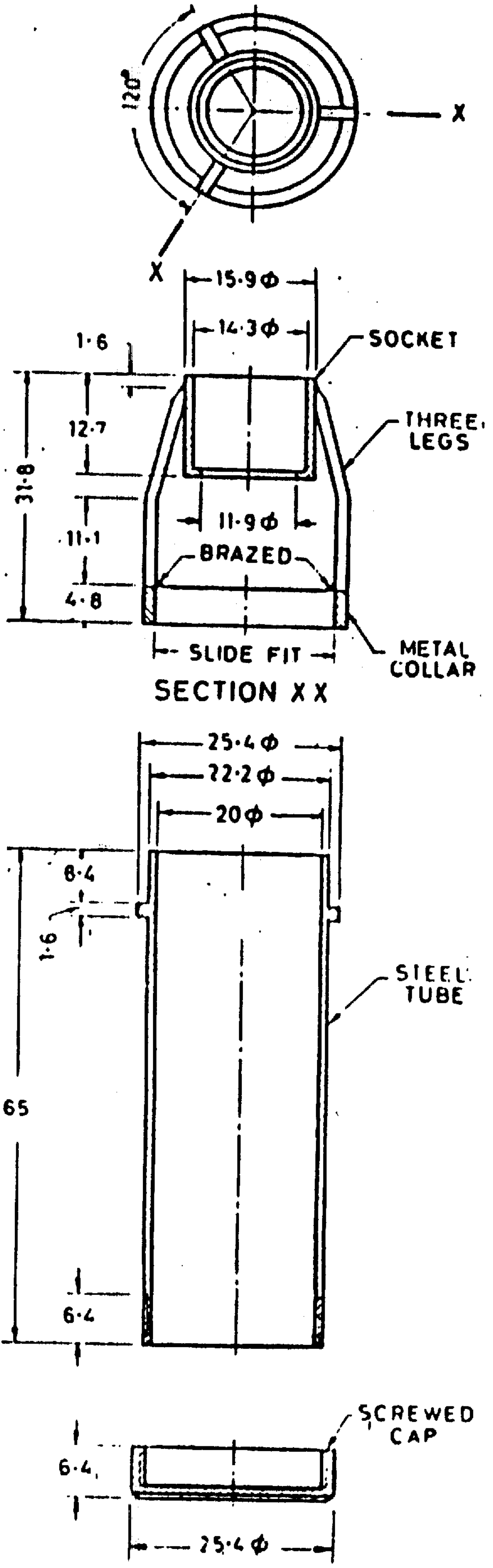
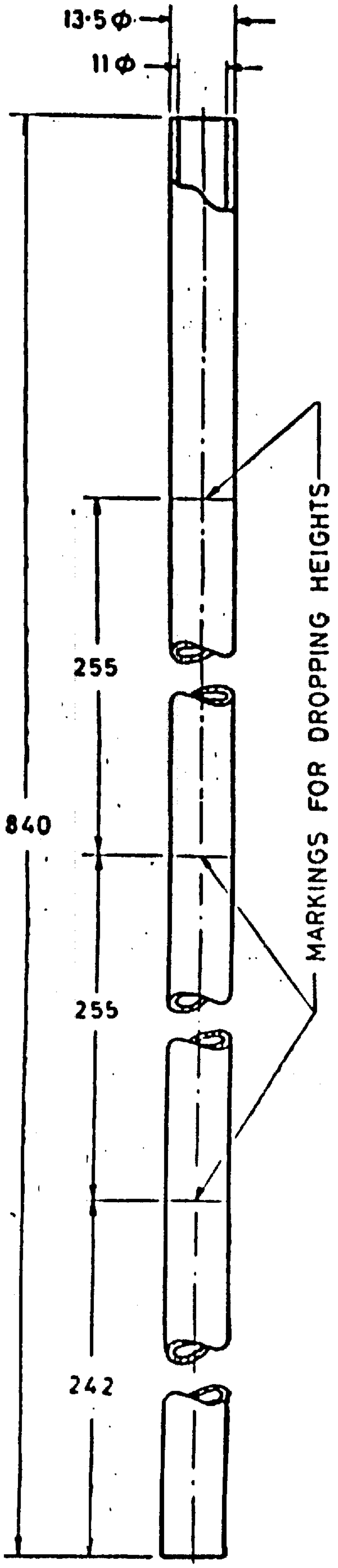


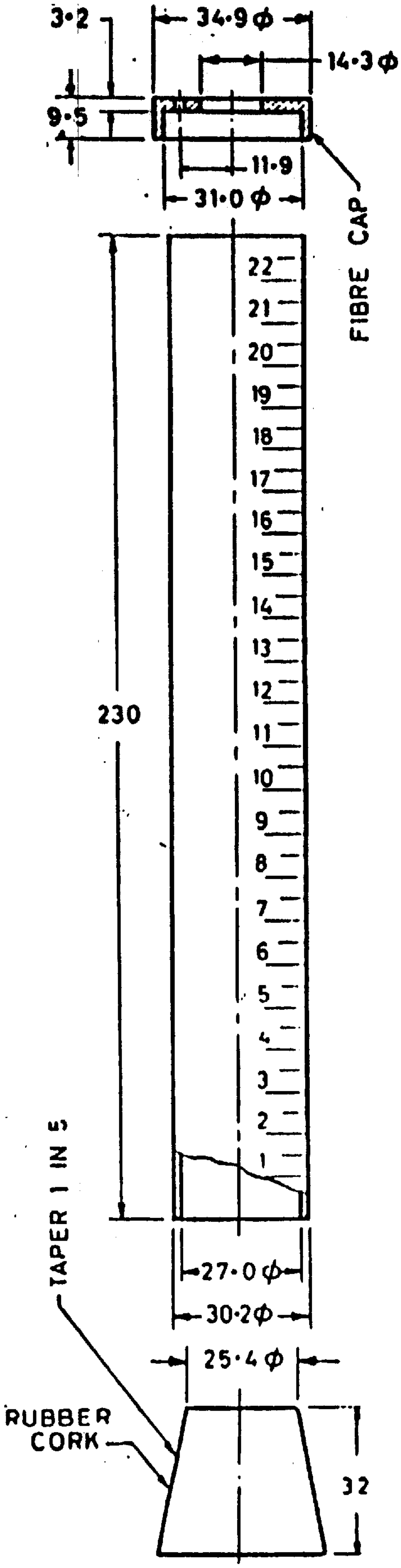
FIG. 1 ASSEMBLY OF APPARATUS FOR THE DETERMINATION OF CONSISTENCY OF GREASES AT VARIOUS TEMPERATURES



All dimensions in millimetres.
Fig. 2 Steel Tube with Metal Collar



All dimensions in millimetres.
Fig. 3 Glass Guide Tube



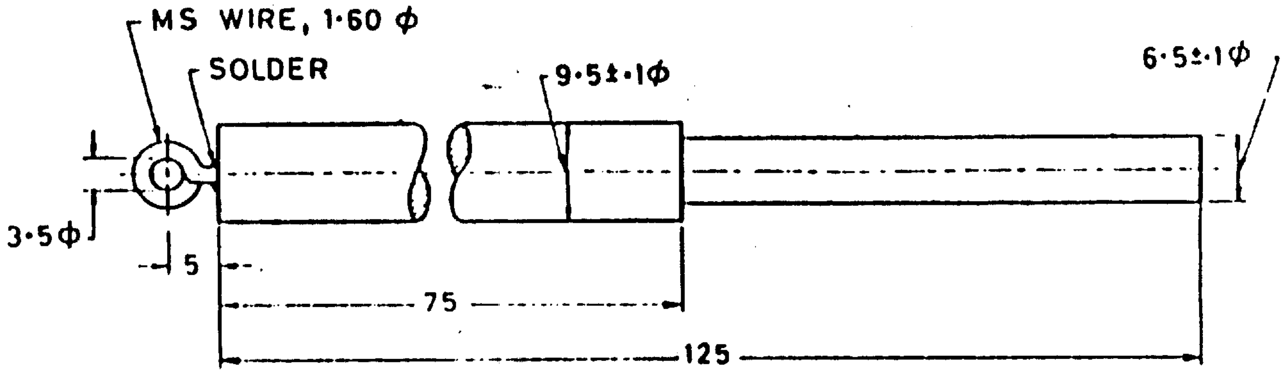
All dimensions in millimetres.
Fig. 4 Graduated Glass Tube

The cap is provided with a suitable hole through which the glass guide tube passes. The steel tube rests inside this tube on a tight-fitting stopper at the bottom and the glass guide tube has about 140·0 mm of its length inserted in it. It can be cooled or heated in a suitable bath. The graduations are used to measure penetration.

3.1.5 *Plunger Rod* — complying with the requirements prescribed under **3.1.5.1** or **3.1.5.2**.

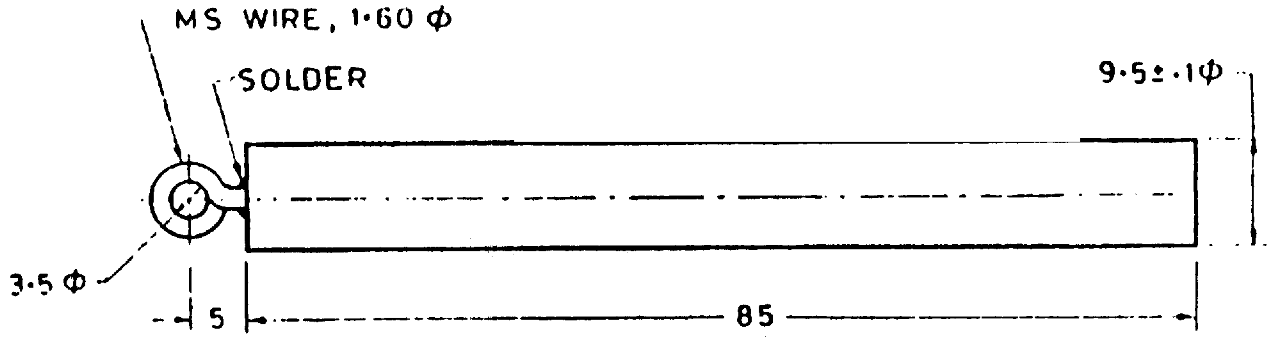
3.1.5.1 *Silver steel plunger rod* (*Fig.* 5) — cylindrical in shape; about 125·0 mm in length, the upper 75·0 mm being 9·5 ± 0·1 mm in diameter and the remaining portion 6·5 ± 0·1 mm in diameter; weighing 55·00 ± 0·05 g. The rod shall be provided with a hook or hole at the thicker end for supporting it vertically by means of a thread and shall be flat at the other end.

3.1.5.2 *Aluminium plunger rod* (*Fig.* 6) — cylindrical in shape; about 85·0 mm in length, 9·5 ± 0·1 mm in diameter, weighing 18·00 ± 0·05 g, made of aluminium of commercial purity. The rod shall be provided with a hook or hole at one end for supporting it vertically by means of a thread and shall be flat at the other end.



All dimensions in millimetres.

FIG. 5 SILVER STEEL PLUNGER ROD



All dimensions in millimetres.

FIG. 6 ALUMINIUM PLUNGER ROD

3.1.6 *Constant Temperature Bath* — a suitable liquid bath which can be adjusted and maintained at the test temperature within ±1.0°C. For temperature lower than atmospheric, a vacuum flask may be used. For higher temperature, a thermostatically controlled liquid bath may be necessary.

NOTE 3 — The freezing mixtures that may be commonly used for determination at low temperatures are as follows:

	For Temperature
Ice and water	Down to 10°C
Crushed ice and common salt	10° to 0°C
Solid carbon dioxide and acetone or ethyl alcohol or gasoline	Below 0°C

4. PROCEDURE

4.1 Work the grease at room temperature in the grease worker prescribed under P : 60* with 60 double strokes in a minute. Fill the steel tube with the worked grease with the help of a spatula avoiding inclusion of air bubbles. Smooth the grease at the lower end of the tube and put on the screw cap. Slightly overfill the upper end with grease to allow for contraction on cooling, if any. Insert the steel tube in the graduated glass tube and place it on the rubber cork that tightly closes the lower end of the latter. Place the graduated tube with its closed-end downward together with its contents in the bath previously adjusted and maintained at the test temperature. At the expiry of 30 minutes remove the graduated glass tube, carefully take out the steel tube and smooth off the open surface of the grease with a spatula. Fit the metal collar to the steel tube and insert the steel tube in the graduated glass tube. Note on the graduated scale the position of the open-end of the steel tube. These operations of smoothing the grease surface and noting the position of the upper end of the steel tube, should be done as quickly as possible. Place the graduated glass tube with its contents in the bath again and maintain at the test temperature for another 30 minutes. Place the glass guide tube in the socket of the metal collar and hold it vertical by means of a clamp. Suspend the plunger in the guide tube at pre-selected height (**4.1.1**) with the help of a piece of thread that passes through a suitable bent glass tube (Fig. 7) fitted on the top of the guide tube by means of a tight fitting cork. The assembly (Fig. 1) shall be such that the plunger rod hangs coaxially with the guide tube and the steel tube. After the expiry of 30 minutes, cut the thread and allow the plunger to drop on the grease. Immediately after drop (in no case allowing more than five seconds to pass), read the position of the top rim of the plunger on the scale of the graduated tube. Calculate the penetration of the grease from this and the initial scale reading referred to above.

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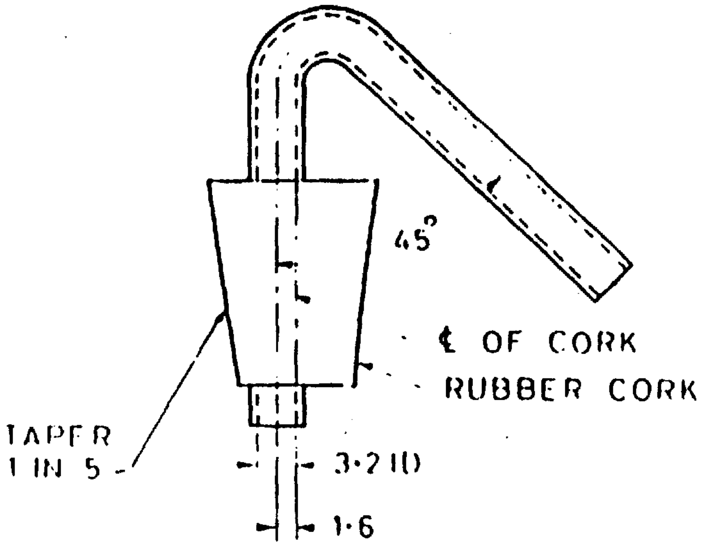
*Under preparation. Until P : 60 is published, a grease worker as agreed to between the contracting parties shall be used.

NOTE 4 — The thermostatically controlled bath can conveniently be replaced by a vacuum flask for temperatures below the ambient. In such cases, the temperature should be maintained at the desired point by dropping small quantities of solid carbon dioxide (if available) and stirring. If solid carbon dioxide be not available, two vacuum flasks both brought down to the desired temperature with freezing mixture should be used one after the other in the two-stage cooling process.



All dimensions in millimetres.

FIG. 7 BENT GLASS TUBE

4.1.1 *Type of Plunger Rod and Its Dropping Height* — As prescribed, either an aluminium or a silver steel rod shall be used according to the nature and consistency of the grease and its performance requirement. The dropping height of these plungers are indicated in Table 1. Other dropping heights may be used for special testing.

TABLE 1 DROPPING HEIGHTS OF PLUNGER

Sl No.	Type of Plunger Rod	Dropping Height
(1)	(2)	(3)
		mm
i)	Aluminium	255
ii)	Aluminium	510
iii)	Aluminium	765
iv)	Silver steel	255
v)	Silver steel	510
vi)	Silver steel	765

5. CALCULATION AND REPORTING

5.1 Calculation — Penetration shall be calculated from the following formula:

$$P = L - (X - Y)$$

where

P = penetration in mm,

L = length of the plunger in mm,

X = reading in mm on the graduated glass tube corresponding to the top rim of the plunger after the drop, and

Y = reading in mm on the graduated glass tube corresponding to the surface of grease.

5.2 Reporting — Penetration shall be reported in millimetres. The type of plunger rod and the dropping height used shall be recorded.

6. PRECISION

6.1 The precision of the method has not been established.